

96 a calculation step, of calculating an average pixel value, by dividing a value of said projection by corresponding number of projected pixels, for each value of said projection; and

a setting step, of setting a characteristic area, from which the pixel value characteristic is obtained, of said radiation image based on said average pixel values.

REMARKS

This application has been reviewed in light of the Office Action dated July 24, 2002. Claims 1-7, 16, 19, and 22-33 are presented for examination. Claims 8-15, 17, 18, 20, and 21 have been canceled, without prejudice or disclaimer of the subject matter presented therein, in response to the finality of the restriction requirement. Claims 1-7, 16, and 19 have been amended to define more clearly what Applicant regards as his invention. Claims 22-33 have been added to provide Applicant with a more complete scope of protection. Claims 1, 16, 19, 22, 25, and 30-33 are in independent form. Favorable reconsideration is requested.

The title has been amended to make it more descriptive, as required in the Office Action. The specification has been amended as to correct references to specific figures.

A Request for Approval of Drawing Changes is submitted herewith, in response to the objections to the drawings set out on page 3 of the Office Action. Applicant, as shown above, has amended to the specification with respect to correcting the references to the Figures identified in the Related Background Art section. In particular, the references to Figures 19 and 20 that appear in the Related Background Art section, have been corrected to read as Figures 29 and 30. It is believed clear that the related Background Art section is discussing

Figures 29 and 30 and not Figures 19 and 20. Note that the proper references to Figures 19 and 20, which are not prior art, appear at least at page 30, line 21 to page 31, line 15. Accordingly, in Applicant's Request for Approval of Drawing Changes, Applicant has requested approval to add the label, "Prior Art" to Figures 29 and 30, not Figures 19 and 20, respectively.

Claims 1, 5-7, 16, and 19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,732,149 (*Kido et al.*) in view of Applicant's admitted prior art disclosed in the Background of the specification on pages 1-3. Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over *Kido et al.* in view of Applicant's admitted prior art as applied to Claim 1, and further in view of U.S. Patent No. 6,035,064 (*Nakao et al.*). Claims 3 and 4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Kido et al.* in view of Applicant's admitted prior art as applied to Claim 1, and further in view of U.S. Patent No. 5,680,471 (*Kanebako et al.*).

As shown above, Applicant has amended independent Claims 1, 16, and 19 in terms that more clearly define the present invention. Applicant submits that these amended independent claims, together with the remaining claims dependent thereon, and new Claims 22-33 are patentably distinct from the cited prior art for at least the following reasons.

The aspect of the present invention set forth in Claim 1 is an image processing method for extracting a pixel value characteristic of a radiation image obtained by radiographing an object. The method comprises the steps of deleting a passing through area from the radiation image, preparing a projection of the image obtained in the deleting step; and setting a characteristic area, from which the pixel value characteristic is obtained, of the radiation image based on the projection.

An important feature of Claim 1 is the steps of deleting a passing through area from the radiation image, and preparing a projection of the image obtained in the deleting step.

Kido et al., as understood by Applicant, relates to an irradiation field region extracting apparatus for radiation images. Apparently, *Kido et al.* discloses that a lung field region, which is a concerned region in the bust radiation image, is recognized by using a local maximum and local minimum in the projection of longitudinal and lateral directions, and the gradation processing condition is determined in accordance with the histogram or the accumulated histogram of the image data in the lung field region. The Office Action correctly states that *Kido et al.* fails to disclose deleting a passing through area from the image. ①

Accordingly, Claim 1 is patentable over *Kido et al.*, taken alone.

The Office Action cites Applicant's prior admitted art for overcoming the deficiencies of *Kido et al.* Applicant's prior admitted art merely discloses the use of a histogram of a remaining area, which is obtained by deleting a passing through area (area in which X rays are directly radiated to the sensor) from the X ray image, in a method of extracting the characteristic amount.

That is, in *Kido et al.* and the admitted prior art, the lung field region recognized by using the projection, and the remaining area, obtained by deleting the passing through area from the X ray image, are merely set as the targets for forming the histogram. None of the cited references disclose that the target for preparing the projection is set to the remaining area. Moreover, none of these references teach or disclose the structure of the present invention, as recited in Claim 1. ②
KIDO TEACHES THIS.

Applicant submits that a combination of *Kido et al.* and the admitted prior art, assuming such combination would even be permissible, would fail to teach or suggest the invention as recited in Claim 1.

Accordingly, Applicant submits that Claim 1 is patentable over the cited art, and respectfully request withdrawal of the rejection under 35 U.S.C. § 103(a).

Independent Claims 16 and 19 are apparatus and storage medium claims respectively corresponding to method Claim 1, and are believed to be patentable for at least the same reasons as discussed above in connection with Claim 1.

Applicant believes that new Claims 22-33 are directed to the elected subject matter of Claims 1-7, 16, and 19, image processing for setting an extraction area from a projection, in that independent Claims 22, 25, and 30-33 set the extraction area based on elements derived from a projection. Furthermore, independent Claims 22, 25, and 30-33 include the similar feature of deleting a passing through area from the radiation image, and preparing a projection of the image obtained in the deleting step, as discussed above in connection with Claim 1.

Accordingly, Claims 22, 25, and 30-33 are believed to be patentable for reasons substantially similar to those discussed above in connection with Claim 1.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicant respectfully requests favorable reconsideration and early passage to issue of the present application.

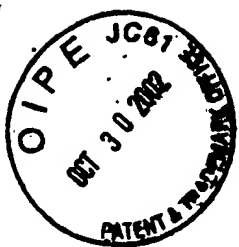
Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,


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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO SPECIFICATION

The paragraph starting at page 1, line 25 has been amended as follows.

For example, Fig. [19] 29 shows an X-ray image 600 which is obtained by X-ray photographing of a cervical vertebra front part. In Fig. [19] 29, an area 601 (black portion) shows a head part, and the other area 602 shows a throat part.

The paragraph starting at page 2, line 3 has been amended as follows.

Here, when the X-ray image 600 is outputted to the film for X-ray diagnosis, first, a characteristic amount of the X-ray image 600 is extracted. In this case, in a method of extracting the characteristic amount, as shown in Fig. [20] 30, used is a histogram of a remaining area which is obtained by deleting a passing through area (area in which X rays are directly radiated to the sensor) from the X-ray image 600. In Fig. [20] 30, abscissa shows pixel value, and ordinate shows output frequency. Therefore, in the histogram, the pixel value (x) of a lower portion, for example, a constant portion (low density portion) point such as 5% point is extracted as the characteristic amount, and the density value of the X-ray image 600 is converted so that the extracted pixel value (x) reaches a density value of about 1.0 on the film.

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Amended) An image processing method for extracting [a characteristic amount] a pixel value characteristic of a [photographed] radiation image [from the photographed image obtained by photographing] obtained by radiographing an object, comprising:

a [passing through] deleting step₁ of deleting a passing through area from said [photographed] radiation image;

a preparing step₂ of preparing a projection [from] of the image [from which said passing through area is deleted] obtained in said deleting step; and

a setting step₃ of setting a characteristic area, from which the pixel value characteristic is obtained, of said [photographed] radiation image based on [a result of] said projection.

2. (Amended) [The image processing] A method according to claim 1, further comprising a binarizing step₄ of binarizing the [photographed image from which said passing through area is deleted] image obtained in said deleting step, wherein in said preparing step, the projection of said binarized [photographed] image is prepared.

3. (Amended) [The image processing] A method according to claim 1, wherein in said preparing step, a weighting processing is performed in accordance with [an input] a pixel value of the image.

4. (Amended) [The image processing] A method according to claim 1, wherein in said preparing step, a weighting processing is performed in accordance with [an input] a pixel position of the image.

5. (Amended) [The image processing] A method according to claim 1, wherein in said setting step, said characteristic area is set [in accordance with a shape] based on secondary difference values of said projection. p.15.

6. (Amended) [The image processing] A method according to claim 1, wherein said object comprises a cervical vertebra.

7. (Amended) [The image processing] A method according to claim 1, wherein said [characteristic amount for] pixel value characteristic extracted from said characteristic area is used to perform a gradation conversion processing.

Claims 8-15 have been canceled.

16. (Amended) An image processing apparatus for extracting [a characteristic amount] a pixel value characteristic of a [photographed] radiation image [from the photographed image obtained by photographing] obtained by radiographing an object, comprising:

[passing through] deleting means for deleting a passing through area from said [photographed] radiation image;

preparing means for preparing a projection [from] of the image [from which said passing through area is deleted] obtained by said deleting means; and

setting means for setting a characteristic area, from which the pixel value characteristic is obtained, of said [photographed] radiation image based on [a result of] said projection.

Claims 17 and 18 have been canceled.

19. (Amended) A [recording] storage medium for storing an image processing program for extracting a pixel value characteristic [amount] of a [photographed] radiation image [from the photographed image] obtained by [photographing] radiographing an object, said program comprising the codes for:

a [passing through] deleting step, of deleting a passing through area from said [photographed] radiation image;

a preparing step, of preparing a projection [from] of the image [from which said passing through area is deleted] obtained in said deleting step; and

a setting step, of setting a characteristic area, from which the pixel value characteristic is obtained, of said [photographed] radiation image based on [a result of] said projection.

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Claims 20 and 21 have been canceled.

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